Claims

1. A plasma spraying method in which a coating material in the form of a powder beam is sprayed onto a surface of a metallic substrate (2), wherein the coating material is injected at a low process pressure, which is lower than 10,000 PA, into a plasma defocusing the powder beam and is there partly or fully melted, characterised in that a plasma with sufficiently high specific enthalpy is produced so that a substantial portion, amounting to at least 5% by weight, of the coating material changes to the vapour phase and an anisotropically structured coating (1) is produced on the substrate with the coating material, with elongate particles (10), which form an anisotropic micro-structure, being aligned standing largely perpendicular to the substrate surface and low-material transitional zones (11, 12) bounding the particles from one another.

2. A plasma spraying method in accordance with claim 1, characterised in that the anisotropically structured coating (1) is a heat insulating coating which is used, for example, in a gas turbine and whose coating thickness has values between 20 and 1000 μm, preferably values of at least 100 μm; and in that the coating is built up from a plurality of layers during manufacture.

3. A plasma spraying method in accordance with claim 1 or claim 2, characterised in that
a) a value is selected for the process pressure between 50 and 2000 Pa, preferably between 100 and 800 Pa and the specific enthalpy of the plasma is produced by emitting an effective power

which has to be determined empirically and which, according to experience, is in the range from 40 to 80 Kw;

b) the powder beam is injected into the plasma with a delivery gas, the process gas being a mixture of inert gases, in particular a mixture of argon Ar and helium He, with the volume ratio of Ar to He advantageously lying in the range from 2 : 1 to 1 : 4 and the total gas flow lying in the range from 30 to 150 SLPM;

c) the powder delivery rate is between 5 and 60 g/min, preferably between 10 and 40 g/min; and

d) the substrate is preferably moved with rotational or pivotal movements relative to a cloud of the defocused powder beam during the material application.

4. A plasma spraying method in accordance with any one of claims 1 to 3, characterised in that a material is used for the coating which includes oxide ceramic components, with such a component being in particular a zirconium oxide fully or partly stabilised with yttrium, cerium or other rare earths and the material used as the stabiliser being added as an alloy to the zirconium oxide in the form of an oxide of the said rare earths.

5. A plasma spraying method in accordance with claim 4, characterised in that, for the powdery coating material, the size distribution of the powder particles is determined by means of a laser scattering method; and in that this size distribution lies to a substantial amount in the range between 1 and 50 μm, preferably between 3 and 25 μm, with in particular spray drying or a

combination of melting and subsequent breaking and/or grinding being used as the method of manufacturing the powder particles.

6. A plasma spraying method in accordance with one of the claims 1 to 5, characterised in that an additional heat source is used in order to be able to carry out the deposition of the coating material within a predetermined temperature range, with a heat input of the heat source and the temperature in the substrate to be coated being controlled or regulated independently of the already named process parameters.

7. Use of the plasma spraying method in accordance with any one of claims 1 to 5 for producing a coating which includes at least one layer (1), in particular a heat insulating layer, having anisotropically structured, elongate particles (10).

8. Use in accordance with claim 6, characterised in that the coating forms a heat insulating coating system (3a, 4, 1, 5) which includes, in addition to the heat insulating coating (1), a base coating (3a, 4) between a base body (3) and the heat insulating coating and/or a cover coating (5) on the heat insulating coating, wherein
a) the base layer includes a hot gas corrosion protection coating (4), whose coating thickness has a value between 10 and 300 μm, preferably between 25 and 150 μm, and which consists, in particular at least in part, of either a metal alumnide of an MeCrAlY alloy, with Me standing for one of the metals Fe, Co or Ni, or of a ceramic oxide material which preferably has an either dense, columnar, directional or unidirectional structure,

b) the cover coating is a smoothing coating whose coating thickness has a value between 1 and 50 μm, preferably between 10 and 30 μm, and which in particular consists at least in part of the same material as or a similar material to the heat insulating coating; and c) the part coatings of the coating system are preferably all applied in a single work cycle by LPPS thin film processes.

9. A component which is coated by application of a coating or of a plurality of coatings (3a, 4, 1, 5) onto a base body (3) by means of the plasma spraying method in accordance with any one of claims 1 to 5, wherein in particular the base body consists of an Ni base alloy or of a Co base alloy.

10. A component in accordance with claim 8, characterised in that a coating system (3a, 4, 1, 5) applied to the base body (3) has been subjected to a heat treatment after the carrying out of the coating processes.

11. A component in accordance with claim 8 or claim 9, characterised in that it is a component of a stationary gas turbine or of an aeroplane power plant, namely a turbine vane, in particular a guide vane or a turbine blade, or a component which can be exposed to hot gas, for example a heat shield.